



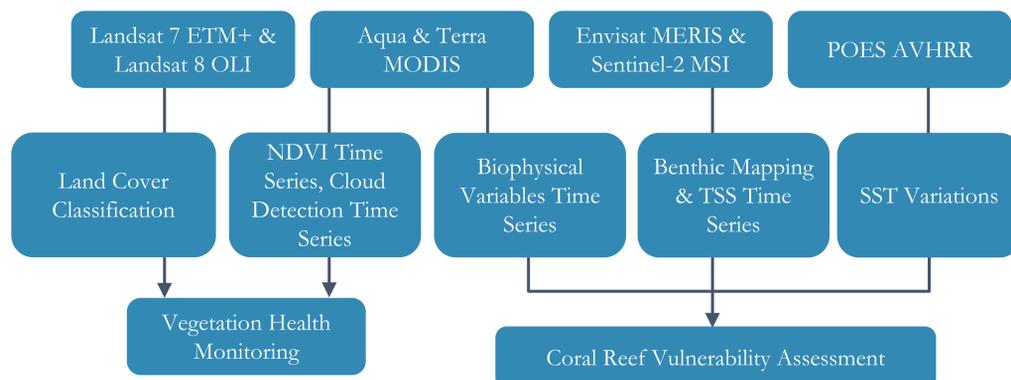
# Assessing Changes in Vegetation and Marine Environments at the Isla del Coco Marine Reserve with Satellite Imagery



## Abstract

The Isla del Coco Marine Reserve resides on the coast of Costa Rica and is undergoing a variety of environmental change, including rising sea surface temperature (SST), coral reef bleaching, coastal erosion, and cloud forest change. Such challenges can not only threaten the well-being of vegetation and marine ecosystems, but also the national park's infrastructure. In response, this project was conducted to provide a better understanding of various environmental threats by using remote sensing time series to assess changes in the island's vegetation and biophysical parameters in the surrounding ocean, including SST, total suspended sediments (TSS), remote sensing reflectance ( $R_{rs}(\lambda)$ ), and inherent optical properties (IOPs). Satellite data from Landsat 7 Enhanced Thematic Mapper Plus (ETM+), Landsat 8 Operational Land Imager (OLI), Moderate Resolution Imaging Spectroradiometer (MODIS), and Medium Resolution Imaging Spectrometer (MERIS) were acquired for March 2002 to October 2016 to analyze health of vegetation types, including cloud forest. NetCDF data products of SST,  $R_{rs}(\lambda)$ , IOPs were converted to raster and subset to aid trend analysis. MERIS level 2 products were used in combination with products derived from Sentinel-2 level 1 data to create a time series analysis for TSS. Results of this project are being used by Sistema Nacional de Áreas de Conservación de Costa Rica, Embassy of Costa Rica to the United States, and the Ministry of Environment and Energy-Water Directorate to help manage and protect the marine reserve.

## Methodology



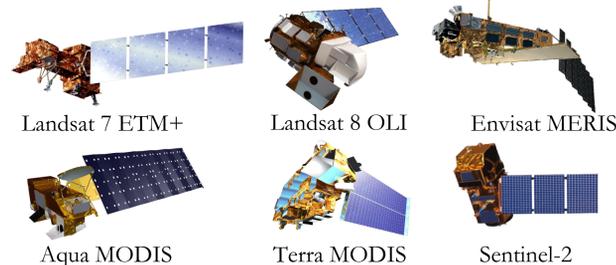
## Objectives

- ▶ **Compile** current and historic land cover maps
- ▶ **Analyze** and create time series of vegetation health and cloud coverage
- ▶ **Estimate** ocean water TSS
- ▶ **Detect** changes in  $R_{rs}(\lambda)$  and IOPs of the deep-water area
- ▶ **Evaluate** annual SST variations

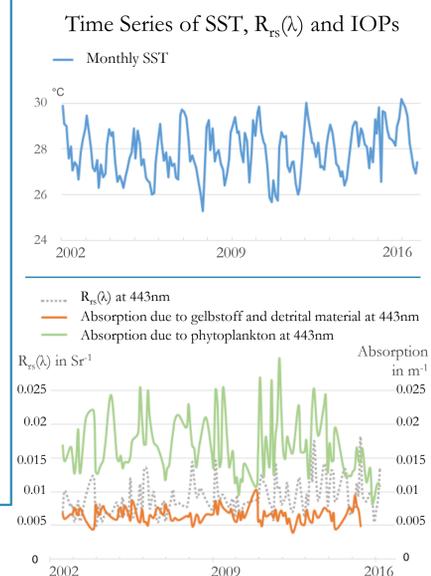
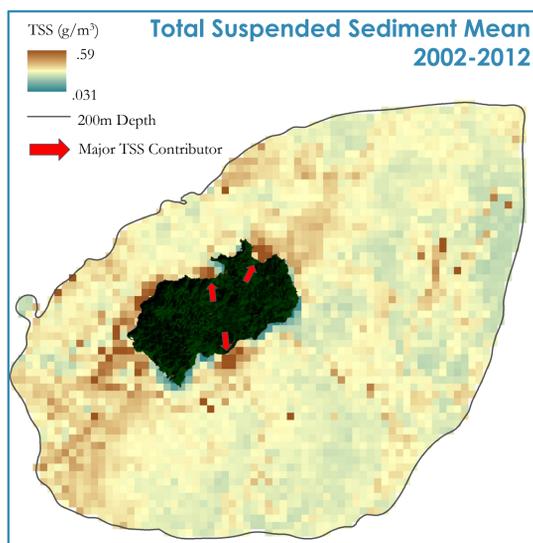
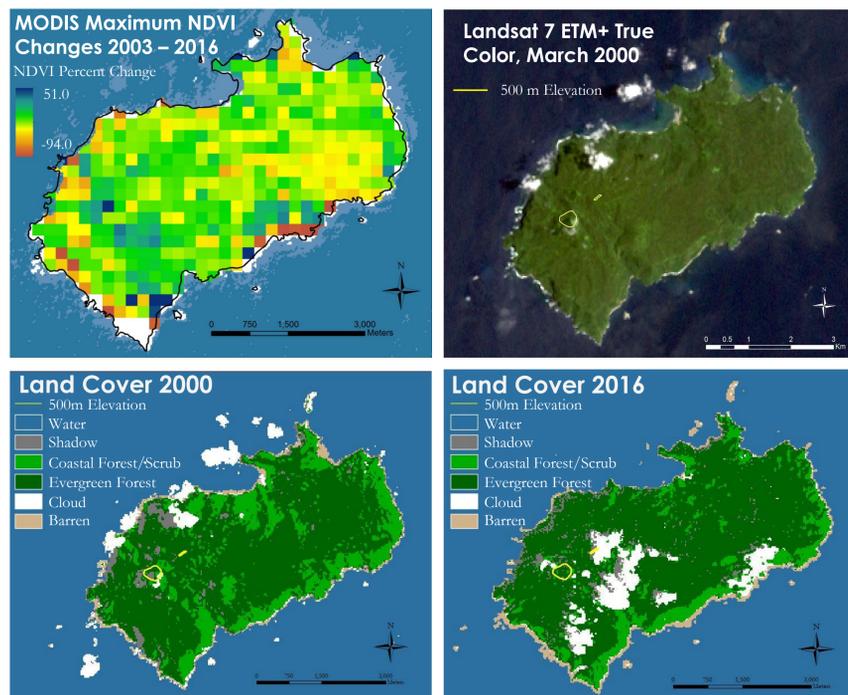
## Study Area



## Earth Observations



## Results



## Conclusions

- ▶ Relatively cloud free Landsat data were useful for mapping land cover and MODIS annual NDVI data showed promise for monitoring vegetation greenness change.
- ▶ Time series analysis of SST,  $R_{rs}(\lambda)$ , IOPs data was used for biogeochemical activity assessment.
- ▶ Bahia Wafer, Chatham, and Iglesias are frequent contributors to TSS based on data ranging from 2002-2012.

## Project Partners

- ▶ Área de Conservación Marina Isla del Coco (ACMIC) (Costa Rica)
- ▶ The Embassy of Costa Rica to the United States
- ▶ The Ministry of Environment and Energy, Water Directorate (DA-MINAE)

## Acknowledgements

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## Team Members

